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ATTACHMENT 1

Sustainable Systems Research, LLC

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May 18, 2016

Adrian Martinez

Staff Attorney

Earthjustice California Office

800 Wilshire Blvd, Suite 1000

Los Angeles, California 90017

Re: Comments on Freight Electrification

Dear Adrian,

I have prepared the attached initial comments in response to your request for evidence of electrifications needs for goods movement. If there is anything additional you need, please do not hesitate to contact me.

Regards,



Deb Niemeier, Ph.D.

Principal

Sustainable Systems Research (SSR), LLC was retained by Earthjustice to review the state of literature supporting electrification of goods movement and evidence of its need in California, particularly with respect to criteria pollutant and attainment of air quality standards.

Dr. Niemeier was the lead author of this review. She has more than 20 years of experience in transportation-air quality and has published more than 150 papers on topics related to air quality, goods movement, environmental justice and climate change. She is currently a professor at the University of California, Davis in the Department of Civil and Environmental Engineering. She is also a member of the NES Board on Energy Systems and the Environment.

In the review that follows, we are focusing specifically on the South Coast region due to the levels of air pollutants and concern over air quality attainment. The region has also experienced enormous growth in port activity, which is a key generator of goods movement.

As this relatively short review clearly demonstrates, no matter what steps CPUC takes, the development and implementation of new zero emissions technologies for goods movement will move the region forward. The greater the investment in new zero emissions technology and infrastructure, the greater the improvements in clean air and human health.

Air Quality and Electrification

The South Coast Air Basin remains out of attainment for ozone and PM. It is unlikely that the PM standards can be met within the near-term future without significant re-direction of the current (fossil fueled) vehicle fleets. Meeting the regional ozone standard requires nearly a two-thirds reduction in NO_x emissions by 2023. With on-road vehicles as the largest source of NO_x,¹ and freight contributing the bulk of that, goods movement will clearly play a featured role in determining whether the ozone standard is attained.

Investments in Infrastructure and Technology Are Critical. Past trends make it clear that investments in infrastructure will significantly improve air quality. By 2011, more than \$1 billion had been spent or was committed to reducing vehicle emissions through technology. Much of the funding went toward accelerating emissions reductions in the freight sector.² Between 1992 and 2011, this investment, in spite of a 38% increase in vehicle activity, produced emissions reductions on the order of 68% to 54% for ROG and NO_x, respectively. The Clean Truck Program, which was a component of the San Pedro Bay Ports Clean Air Action Plan, targeted fleet technology changes specifically in drayage trucks. The result of this program was a decline

¹ Fred Lurmann, Ed Avol & Frank Gilliland (2015) Emissions reduction policies and recent trends in Southern California's ambient air quality, Journal of the Air & Waste Management Association, 65:3, 324-335, DOI: 10.1080/10962247.2014.991856

² For example, the Carl Moyer Program, the Goods Movement Emission Reduction Program, and the Fleet Modernization Program.

in drayage truck air pollutant emissions of over 95% between 2005 and 2012.³ Historically, regardless of the regulatory or policy impetus, technology changes aimed at reducing vehicle emissions have demonstrated an exceptionally high rate of return for air quality and human health.

With the Ports of Los Angeles (LA) and Long Beach handling more than 60% of the west coast freight, and truck VMT on area highways expected to grow by nearly 80%,⁴ the potential for goods movement-related vehicle emissions to exacerbate regional air quality problems is significant. The implementation of clean technology across all sectors of goods movement will be critical if federal air quality standards are to be met. Electrification, both onsite cargo handling and drayage, has the potential to offset both greenhouse gas emissions as well as criteria pollutants.

Drayage Electrification. Container volume handled through the Ports of LA/Long Beach is expected to grow 3% annually through 2035. Converted to twenty-foot equivalent units (TEU's), this reflects an increase of approximately 13 million TEUs by 2035 (15 million in 2015 to 28 million in 2035). In California, drayage trucks are class 7 or 8 trucks (GVWR greater than 26,000 lbs) and move cargo between the port and near and off-dock intermodal facilities.

A recent study examining two scenarios found that electrification of drayage trucks had the potential to significantly reduce local pollutants as well as greenhouse gases (GHG).⁵ In the first scenario, 50% of near-dock VMT is met with electric trucks by 2035; in the second scenario, 50% of both near-dock and off-dock drayage VMT is met with electric trucks, again by 2035. Both of these scenarios are compared to business-as-usual.

The results of the analysis show that NO_x emissions would be reduced by 3% under the near dock scenario (scenario 1) and by as much as 28% under the near-dock and off-dock electrification scenario (scenario 2). These results clearly suggest that a comprehensive approach that focuses on combined near-dock and off-dock electrification of drayage trucks yields far greater benefits than electrifying a portion of the near-dock drayage fleet.

Onsite Cargo Handling Electrification. The need for ports to take on a more proactive role in energy management has given rise to the concept of ports as energy hubs, managing both supply and demand activities.⁶ On the demand side, ports provide substantial amounts of energy for

³ Gunwoo Lee, Soyoung (Iris) You, Stephen G. Ritchie, Jean-Daniel Saphores, R. Jayakrishnan, Oladele Ogunseitan, Assessing air quality and health benefits of the Clean Truck Program in the Alameda corridor, CA, Transportation Research Part A: Policy and Practice, Volume 46, Issue 8, October 2012: 1177-1193, ISSN 0965-8564, <http://dx.doi.org/10.1016/j.tra.2012.05.005>

⁴ SCAG. On the move: Southern California delivers the goods, Southern California Association of Governments 2012.

⁵ Ambrose, Hanjiro, and Miguel Jaller. "ELECTRIFICATION OF DRAYAGE TRUCKS: ON TRACK FOR A SUSTAINABLE 1 FREIGHT PATH 2." *Transportation Research Board 95th Annual Meeting*. No. 16-5924. 2016.

⁶ Acciaro, Michele, Hilda Ghiara, and Maria Inés Cusano. "Energy management in seaports: A new role for port authorities." *Energy Policy* 71 (2014): 4-12.

direct port activities (terminals, locks, bridges, lighting, etc); powering ships, and port-related activities (refineries, railway, metal works, etc). On the supply side, ports are also under significant pressure to reduce emissions, thus motivating the development and use of alternative, usually onsite, fuels. In European ports, such as Hamburg, Germany, smart grids and virtual power plants are being explored.⁷

In California, despite the fact that onsite electrification has long been seen as key strategic goal in managing California port emissions, much of the effort to date has been focused on relatively easy targets. For example, within the category of cargo handling, yard tractors are typically the largest emitter of GHGs⁸ and an easy target for electrification. However, if onsite electrification projects are coupled with improvements in renewable generation,⁹ the potential benefits – both in terms of geographic scale and reductions in air pollutants - could be much larger. For example, a recent study of the effect of requiring ships to deploy shore power using grid electricity at the Port of LA resulted in a net benefit in terms of emissions reduction to society.¹⁰ If this were coupled to an increase in microgrid renewable generation, the net effect would be much bigger. Without a requirement to utilize shore power, ships have little incentive to do so. Managing ports as an energy hub with an integrated perspective on supply and demand will almost certainly be the next level of innovation in port facility administration.

Long-Range Transportation Plans and Electrification

Green investment in goods movement infrastructure and technology will be required to make federal clean air standards in many regions. This imperative to move to electrification is echoed in long-range plans throughout the state. In the South Coast, SCAG's new long-range plans highlight clean energy investments in near dock rail, hybrid/electric near dock drayage trucks, and study of electrified rail technologies among others. It is particularly noteworthy that one of the largest obstacles mentioned is not the availability of suitable vehicle technology, but rather the lack of sufficiently large enough deployment: *"For trucks, several near-zero emission clean-fuel trucks and hybrid trucks are currently available but require a more aggressive deployment."*¹¹

In fact, critical to electrification of trucks as enumerated in the SCAG's long range plan is adequate deployment of charging stations or investment in catenary systems.¹² Charging stations

⁷ Schäfers, H. (2012). How smart grids can be profitable and the e-harbours showcase of hamburg. In: E-Harbours Midterm Conference, May 2012, Bruges, Belgium

⁸ Starcrest. 2010. The Port of Los Angeles 2009 Inventory of Air Emissions. Poulsbo, WA: Starcrest Consulting Group.

⁹ Kim, Jae, Mansour Rahimi, and Josh Newell. "Life-cycle emissions from port electrification: A case study of cargo handling tractors at the port of Los Angeles." *International Journal of Sustainable Transportation* 6.6 (2012): 321-337.

¹⁰ Vaishnav, Parth, et al. "Shore Power for Vessels Calling at US Ports—Benefits and Costs." *Environmental science & technology* (2015).

¹¹ SCAG

¹² IBID

would serve off dock drayage needs and could be invested in as warehousing facilities are established throughout the region. Distributed charging systems have the greatest potential for quickly reducing region-wide emissions.

Deploying electric systems aimed at reducing emissions from goods movement is considered essential to the success of the current SCAG RTP. In fact, in review of the 2040 Draft California Transportation Plan, South Coast officials commented, “Attaining the federal [air quality] standards will require broad deployment of zero and near-zero emission technologies. Goods movement, which is by far the largest source of NOx emissions, must be a part of the zero-emission solution.”¹³ That is, even with expected on-road truck fleet turnover, it will only be possible to meet federal air quality standards with significant investment in zero emissions infrastructure and technology. Moreover, it is clear that South Coast officials do not expect to meet state climate targets without the zero emissions investments.

The ability to place distributed energy storage sites throughout the region can help to address power needs at different timescales (e.g., a few hours to overnight charging needs).¹⁴ Equally important, initial investments consistent with the RTP can have the added advantage of providing infrastructure assets for greater deployment of, for example, commercial delivery fleets. These vehicles typically operate in the 8a to 8p timeshed with relatively predictable operational schedules. Carefully designed, both public and private systems could provide commercial truck services with vehicle to grid (V2G) opportunities. In fact, recent studies suggest that providing V2G regulation services could generate as much \$20,000 to \$50,000 over truck life cycle costs and produce a significant reduction in GHGs.¹⁵

Concluding Statement

Past investments in low emitting and zero emitting technology and infrastructure have resulted in significant improvements in air quality. California now stands at a very important junction. Without rapid and expansive deployment of zero emissions investments in the area of freight, the state will be unlikely to make air quality attainment or GHG thresholds. Any investment in zero emissions freight-related projects will move the state forward and, based on past experience, cascade into even greater benefits, for example, higher penetration of vehicles, technology and infrastructure, than initially envisioned.

¹³ Hogo, H. (2015) *Letter to Gabriel Corley, SCAQMD Staff Comments Regarding the Draft California Transportation Plan 2040*, Submitted April 17 to Caltrans, p2.

¹⁴ Chu, S., Majumber, (2012) Opportunities and challenges for a sustainable energy future, *Nature*, 488, 294-303, <http://dx.doi.org/10.1038/nature11475>

¹⁵ Yang Zhao, Mehdi Noori, Omer Tatari, (2016) Vehicle to Grid regulation services of electric delivery trucks: Economic and environmental benefit analysis, *Applied Energy*, Volume 170: pps 161-175, <http://dx.doi.org/10.1016/j.apenergy.2016.02.097>.